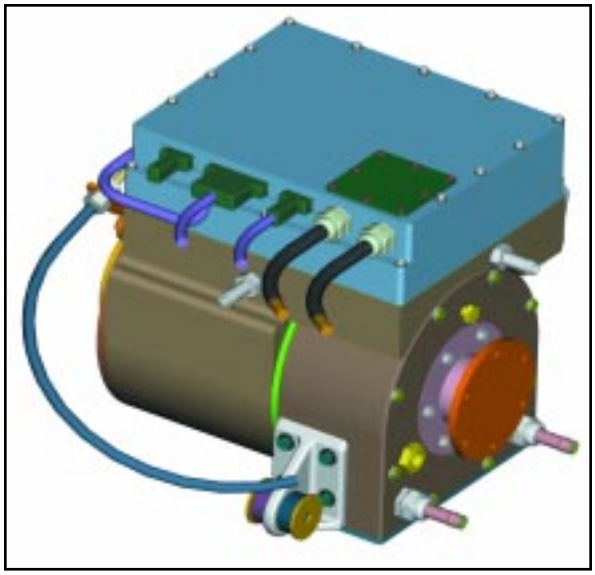
System design lowers parts counts, uses off-the-shelf components and lowers costs

OAAT ACCOMPLISHMENTS

Integrated Electric Traction System for EVs and HEVs

Challenge

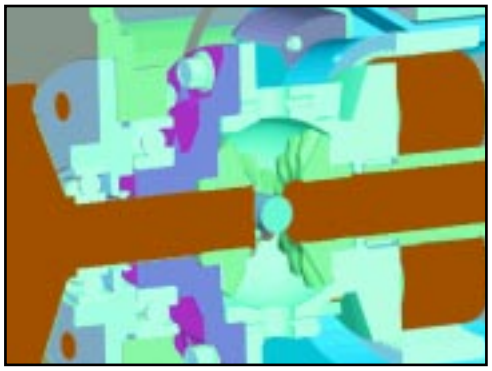
Small, low-cost electric motors are critical to enabling hybrid electric vehicles (HEVs) to achieve greatly increased fuel economy and significantly reduced emissions over conventional vehicles. Development of an integrated electric traction system will help such vehicles meet PNGV performance and cost targets.



The motor develops sufficient torque and power (1650 N-m and 70 kW) to power a 5-passenger car in a package that is 280 mm (11 inches) in diameter and 380 mm (15 inches) in length.

Technology Description

The primary objective of this Phase II SBIR project is to design, build and test an integrated electric traction system for battery-only as well as hybrid electric vehicles. The system includes a brushless permanent magnet motor, epicyclic single-stage gearing, differential, parking pawl, and an optional integrated inverter. System design minimizes the number of parts and maximizes the use of lower-cost off-the-shelf automotive components. Modular design will provide further cost advantages by allowing smaller production runs of different size systems using a large number of identical parts.



The highly compact motor design required the development of an innovative rotor cooling system.

The integrated inverter shares the packaging and reduces electromagnetic inductance (EMI) through internal shielded connections with high-voltage motor leads. Advanced computer-aided design techniques are employed for ensuring high performance and efficient cooling of the compact motor. The motor is designed to exceed PNGV performance requirements and meet PNGV cost targets.

Accomplishments

During FY 2000, UQM Technologies, Inc. analyzed the performance of the motor over several U.S. and European duty cycles. A rotor cooling concept was successfully developed and tested.

The first integrated unit has been built and extensive testing is under way. A detailed engineering specification has been developed for OEM evaluation and feedback.

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Benefits

The design is configurable, with or without the integrated inverter, with or without the parking pawl.

The motor length is scalable for other power ratings.

The integrated system will offer extremely low EMI.

Low parts count, use of off-the-shelf automotive gears and components, and modular design will result in a low-cost, highly reliable electric traction system with a projected life of 150,000 miles.

Future Activities

The first bench test unit has been assembled. Testing will include Failure Modes and Effects Analysis (FMEA), Design Verification Plan and Report (DVP&R), and EMI testing. Test results, along with OEM feedback on the engineering specifications, will be used to make final adjustments to the design. Final unit and hardware specifications are expected to be available in October 2001.

Partner in Success

- UQM Technologies, Inc. (formerly Unique Mobility, Inc.)